Discussion of the convergence of ChPT for baryons

Need to parameterize quark mass and finite volume effects of baryon masses.

- ★ Some analyses involve parameterization driven fits to data, e.g., involve more precise data away from the physical point (on smaller volumes) $\rightarrow$ need to know convergence properties of the model.

- ★ Difficult to test systematically (in the continuum limit). Wide range of ensembles, including small pion masses needed.

ChPT encodes flavour symmetries and can be formulated in a finite volume $\rightarrow$ modest number of parameters at a given order compared to, e.g., a Taylor expansion.

- ★ What ChPT to use: heavy baryon vs covariant baryon ChPT vs ChPT inspired models?

- ★ Convergence properties of ChPT, what order for what range of meson masses for a given precision. What do we know for SU(2) or SU(3)?

★ Fits to different quantities, which share some common LECs, lead to different estimates → fit quantities together, e.g., M_B and g_B for octet B. However, ChPT expansion works better for some quantities than others.

Scale setting using the Omega mass

★ Is baryon ChPT needed for M_Ω along $m_s \approx$const (only sea quark effect)? Is parameterisation dependence significant?

Is the uncertainty associated with the quark mass (and volume) dependence small compared to the overall error in the scale?

★ For a set of ensembles where the strange as well as the light quark vary (e.g. CLS tr$M$ =const. trajectory) → SU(3) ChPT or Taylor expansion or ...

If SU(3) ChPT it can be difficult estimate systematics, e.g., by making cuts on the meson masses. Make the cut on which meson mass? E.g. for CLS tr$M$ =const. trajectory.

Best strategy for reducing the parameterisation dependence?

Constraining the quark mass dependence (shifting to physical point when fitting):

- ★ More than one trajectory to the physical point
- ★ Encircling the physical point

Or simulating at approximately the physical point and correct for small mis-tuning (fitting or by computing the derivatives).

Is there still a benefit to simulating at (significantly) heavier than unphysical quark mass, e.g. up to 400 MeV?

Other uses of ChPT: understanding excited state contamination, ...